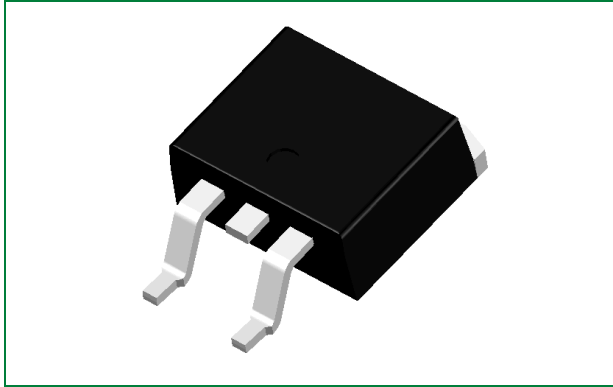


# LGB8245T1

## 450 V, 20 A N-Channel Ignition IGBT



### Product Summary

Characteristic	Value	Unit
$V_{CES}$	450	V
$I_c$	20	A

### Description

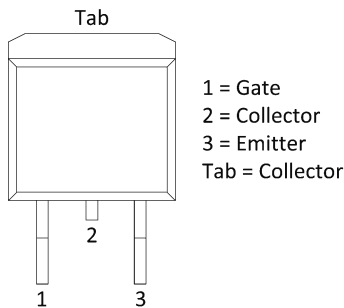
This Logic Level Insulated Gate Bipolar Transistor (IGBT) features monolithic circuitry integrating ESD and Over-Voltage clamped protection for use in inductive coil drivers applications. Primary uses include Ignition, Direct Fuel Injection, or wherever high voltage and high current switching is required.

### Agency Approvals

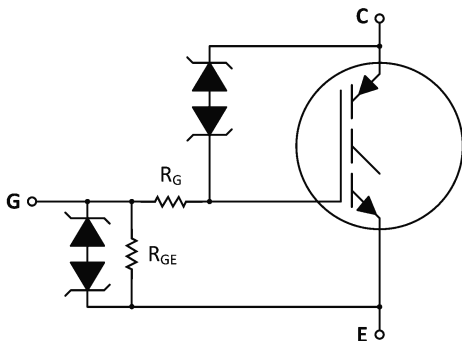
Environmental Approvals



### Pinout Diagram



### Functional Diagram



### Features

- Ideal for Coil-on-Plug and Driver-on-Coil Applications
- D2PAK Package Offers Smaller Footprint for Increased Board Space
- Gate-Emitter ESD Protection
- Temperature Compensated Gate-Collector Voltage Clamp Limits Stress Applied to Load
- Low Threshold Voltage Interfaces Power Loads to Logic or Microprocessor Devices
- Low Saturation Voltage
- High Pulsed Current Capability
- AEC-Q101 Qualified
- These are Pb-Free Devices

### Applications

- Ignition Systems

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## 1. Maximum Ratings (T<sub>J</sub> = 25 °C unless otherwise specified)

Characteristic	Conditions	Symbol	Value	Unit
Collector-Emitter Voltage	-	V <sub>CES</sub>	500	V
Gate Voltage	-	V <sub>CER</sub>	500	V
Gate-Emitter Voltage	-	V <sub>GE</sub>	±15	V
Collector Current – Continuous	T <sub>C</sub> = 25 °C	I <sub>C</sub>	20	A <sub>DC</sub>
Collector Current – Pulsed			50	A <sub>AC</sub>
Continuous Gate Current	-	I <sub>G</sub>	1.0	mA
Transient Gate Current	t < 2 ms, f ≤ 100 Hz		20	mA
ESD – Human Body Model	R = 1500 Ω, C = 100 pF	ESD	8.0	kV
ESD – Machine Model	R = 0 Ω, C = 200 pF		500	V
Total Power Dissipation	T <sub>C</sub> = 25 °C	P <sub>D</sub>	150	W
	Derating for >25 °C		1.0	W/°C
Operating and Storage Temperature Range	-	T <sub>J</sub> , T <sub>stg</sub>	-55 to +175	°C

## 2. Unclamped Collector-to-Emitter Avalanche Characteristics

Characteristic	Symbol	Value	Unit
Single Pulse Collector-to-Emitter Avalanche Energy			
V <sub>CC</sub> = 50 V, V <sub>GE</sub> = 5.0 V, P <sub>kL</sub> = 9.5 A, L = 3.5 mH, R <sub>G</sub> = 1 kΩ, Starting T <sub>C</sub> = 150 °C	E <sub>AS</sub>	158	mJ

Note: -55 °C ≤ T<sub>J</sub> ≤ 150 °C

## 3. Thermal Characteristics

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Case	R <sub>θJC</sub>	1.0	°C/W
Thermal Resistance, Junction to Ambient (D2PAK) <sup>1</sup>	R <sub>θJA</sub>	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds	T <sub>L</sub>	275	°C

Footnote 1: When surface mounted to an FR4 board using the minimum recommended pad size

## 4. Electrical Characteristics – Off

Characteristic	Symbol	Conditions	Temperature	Value			Unit
				Min	Typ	Max	
Collector-Emitter Clamp Voltage	BV <sub>CES</sub>	I <sub>C</sub> = 2.0 mA	T <sub>J</sub> = -40 °C to 175 °C	430	450	470	V
		I <sub>C</sub> = 10 mA		450	475	500	
Collector-Emitter Clamp Voltage <sup>4</sup>	BV <sub>CES</sub>	I <sub>C</sub> = 12 mA, L = 3.5 mH, R <sub>G</sub> = 1 kΩ	T <sub>J</sub> = -40 °C to 175 °C	420	450	480	V
Collector-Emitter Leakage Current	I <sub>CES</sub>	V <sub>CE</sub> = 15 V, V <sub>GE</sub> = 0 V	T <sub>J</sub> = 25 °C	-	0.002	1.0	μA
		V <sub>CE</sub> = 250 V, R <sub>G</sub> = 1 kΩ	T <sub>J</sub> = -40 °C to 175 °C	0.5	2.0	100	
Reverse Collector-Emitter Leakage Current	I <sub>ECS</sub>	V <sub>CE</sub> = -24 V	T <sub>J</sub> = 25 °C	-	0.4	1.0	mA
			T <sub>J</sub> = 175 °C	-	20	35	
			T <sub>J</sub> = -40 °C	-	0.04	0.2	
Reverse Collector-Emitter Clamp Voltage	BV <sub>CES(R)</sub>	I <sub>C</sub> = -75 mA	T <sub>J</sub> = 25 °C	30	33	39	V
			T <sub>J</sub> = 175 °C	31	35	40	
			T <sub>J</sub> = -40 °C	30	31	37	
Gate-Emitter Clamp Voltage	BV <sub>GES</sub>	I <sub>G</sub> = ±5.0 mA	T <sub>J</sub> = -40 °C to 175 °C	12	12.5	14	V
Gate-Emitter Leakage Current	I <sub>GES</sub>	V <sub>GE</sub> = ±5.0 V	T <sub>J</sub> = -40 °C to 175 °C	200	316	350	μA
Gate-Emitter Resistor	R <sub>GE</sub>	-	T <sub>J</sub> = -40 °C to 175 °C	14.25	16	25	kΩ
Gate Resistor	R <sub>G</sub>	-	T <sub>J</sub> = -40 °C to 175 °C	-	70	-	Ω

## 5. Electrical Characteristics – On

Characteristic	Symbol	Conditions	Temperature	Value			Unit
				Min	Typ	Max	
Gate Threshold Voltage	$V_{GE(th)}$	$I_C = 1.0 \text{ mA}$ , $V_{GE} = V_{CE}$	$T_J = 25 \text{ }^\circ\text{C}$	1.5	1.8	2.1	V
			$T_J = 175 \text{ }^\circ\text{C}$	0.7	1.0	1.3	
			$T_J = -40 \text{ }^\circ\text{C}$	1.7	2.0	2.3	
Threshold Temperature Coefficient (Negative)	-	-	-	4.0	4.6	5.2	mV/ $^\circ\text{C}$
Collector-Emitter On-Voltage	$V_{CE(on)}$	$I_C = 10 \text{ A}$ , $V_{GE} = 3.7 \text{ V}$	$T_J = -40 \text{ }^\circ\text{C}$ to $175 \text{ }^\circ\text{C}$	0.8	1.11	1.97	V
		$I_C = 10 \text{ A}$ , $V_{GE} = 4.0 \text{ V}$	$T_J = -40 \text{ }^\circ\text{C}$ to $175 \text{ }^\circ\text{C}$	0.8	1.10	1.85	
		$I_C = 15 \text{ A}$ , $V_{GE} = 4.0 \text{ V}$	$T_J = -40 \text{ }^\circ\text{C}$ to $175 \text{ }^\circ\text{C}$	0.8	1.24	2.00	
Forward Transconductance	gfs	$V_{CE} = 5.0 \text{ V}$ , $I_C = 6.0 \text{ A}$	$T_J = 25 \text{ }^\circ\text{C}$	10	19	25	Mhos

## 6. Dynamic Characteristics

Characteristic	Symbol	Conditions	Temperature	Value			Unit
				Min	Typ	Max	
Input Capacitance	$C_{ISS}$	$V_{CE} = 25 \text{ V}$ , $f = 10 \text{ kHz}$	$T_J = -25 \text{ }^\circ\text{C}$	1100	1400	1600	pF
Output Capacitance	$C_{OSS}$			50	65	80	
Transfer Capacitance	$C_{RSS}$			15	20	25	

## 7. Switching Characteristics

Characteristic	Symbol	Conditions	Temperature	Value			Unit
				Min	Typ	Max	
Turn-on Delay Time (Resistive) 10% $V_{GE}$ to 10% $I_C$	$t_{d(on)R}$	$V_{CE} = 14 \text{ V}$ , $V_{GE} = 5.0 \text{ V}$ , $R_G = 1.0 \text{ k}\Omega$ , $R_L = 1.0 \text{ }\Omega$	$T_J = -40 \text{ }^\circ\text{C}$ to $175 \text{ }^\circ\text{C}$	0.1	1.0	2.0	$\mu\text{s}$
Rise Time (Resistive) 10% $I_C$ to 90% $I_C$	$t_{rR}$			1.0	3.4	6.0	
Turn-off Delay Time (Resistive) 90% $V_{GE}$ to 90% $I_C$	$t_{d(off)R}$			2.0	4.5	8.0	
Fall Time (Resistive) 90% $I_C$ to 10% $I_C$	$t_{fR}$			3.0	8.0	12	
Turn-off Delay Time (Inductive) 90% $V_{GE}$ to 90% $I_C$	$t_{d(off)L}$	$V_{CE} = BV_{CES}$ , $L = 0.5 \text{ mH}$ , $R_G = 1.0 \text{ k}\Omega$ , $I_C = 10 \text{ A}$ , $V_{GE} = 5.0 \text{ V}$	$T_J = -40 \text{ }^\circ\text{C}$ to $175 \text{ }^\circ\text{C}$	6.5	9.7	12.5	$\mu\text{s}$
Fall Time (Inductive) 90% $I_C$ to 10% $I_C$	$t_{fL}$			6.0	8.3	11	

Note: Electrical Characteristics at temperature other than 25 °C, Dynamic and Switching characteristics are not subject to production testing. Not subject to production testing.

## 8. Figure Data

Figure 1. Self-Clamped Inductive Switching

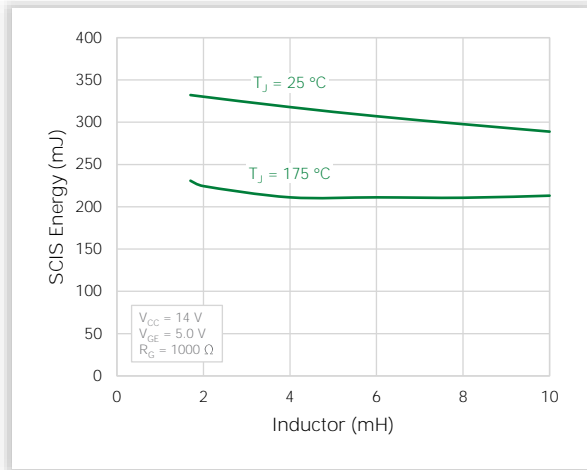


Figure 2. Open Secondary Avalanche Current vs. Temperature

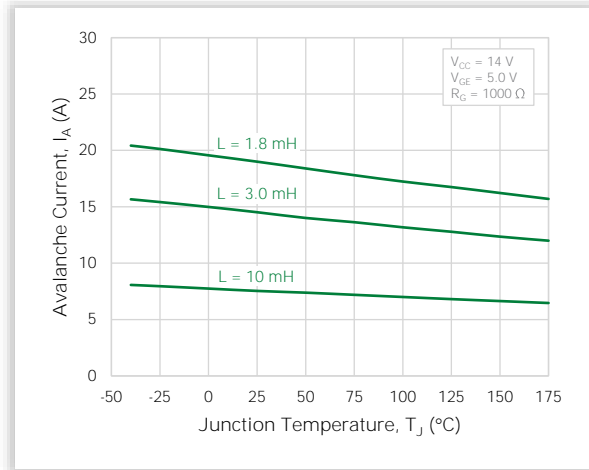


Figure 3. Collector-Emitter Voltage vs. Junction Temperature

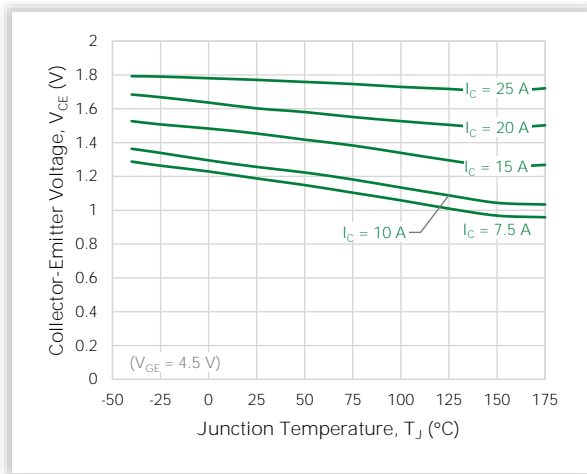


Figure 4. Output Characteristics (T<sub>J</sub> = 25 °C)

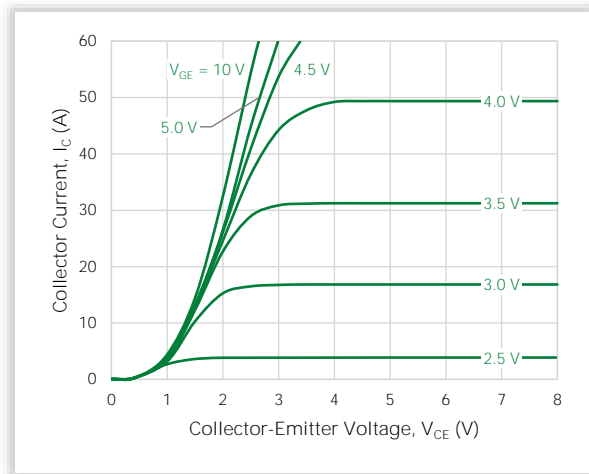


Figure 5. Output Characteristics (T<sub>J</sub> = -40 °C)

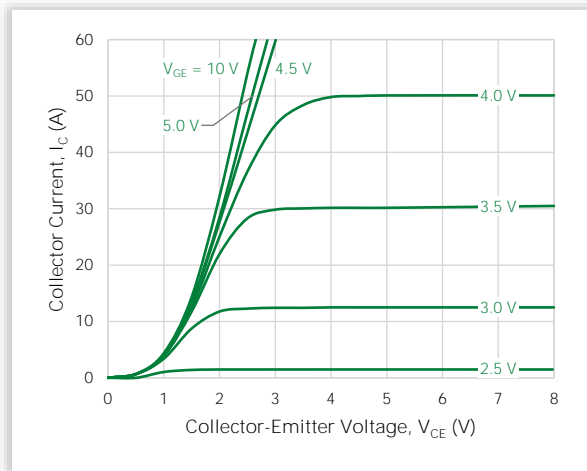


Figure 6. Output Characteristics (T<sub>J</sub> = 175 °C)

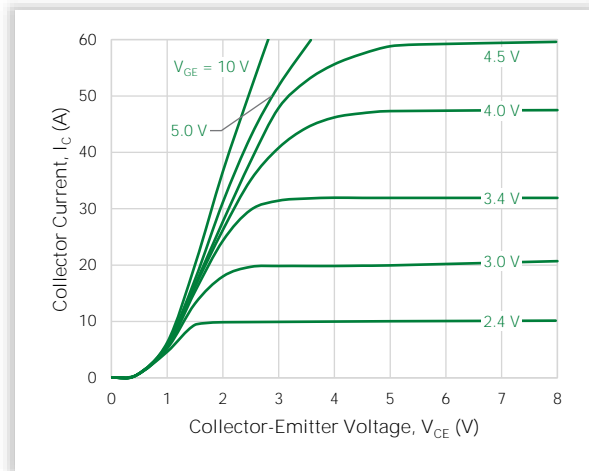


Figure 7. Transfer Characteristics

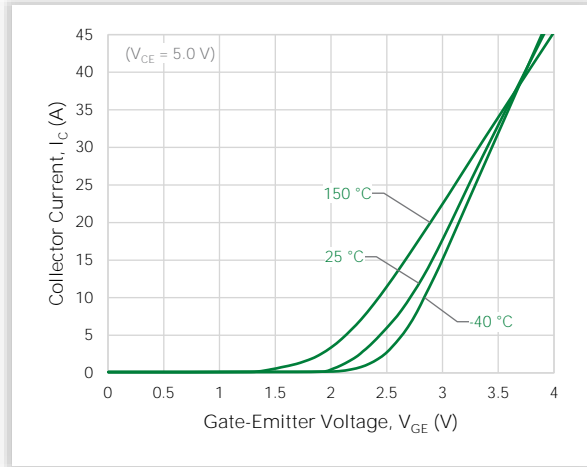


Figure 8. Collector-Emitter Leakage Current vs. Temperature

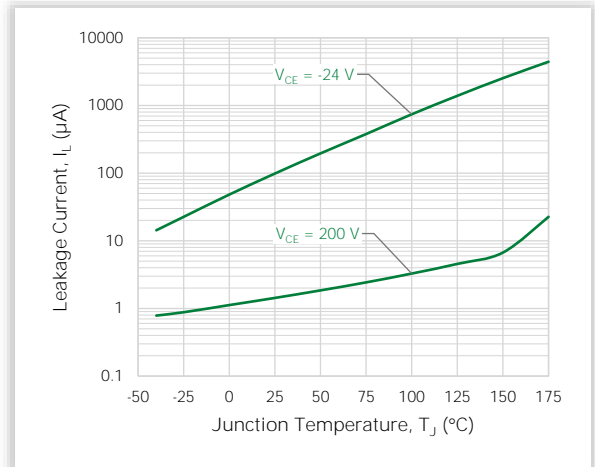


Figure 9. Gate Threshold Voltage vs. Temperature

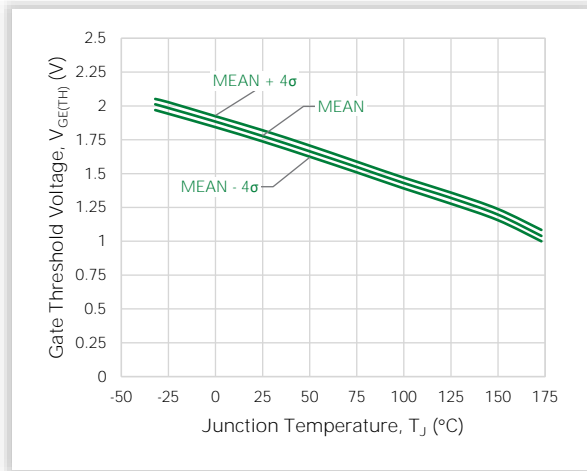


Figure 10. Capacitance Variance

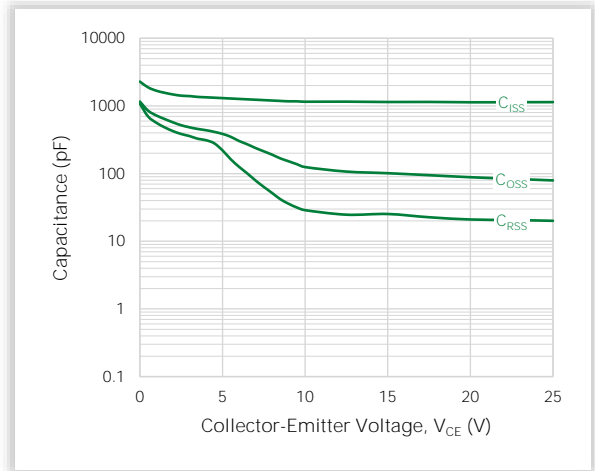


Figure 11. Resistive Switching Fall Time vs. Temperature

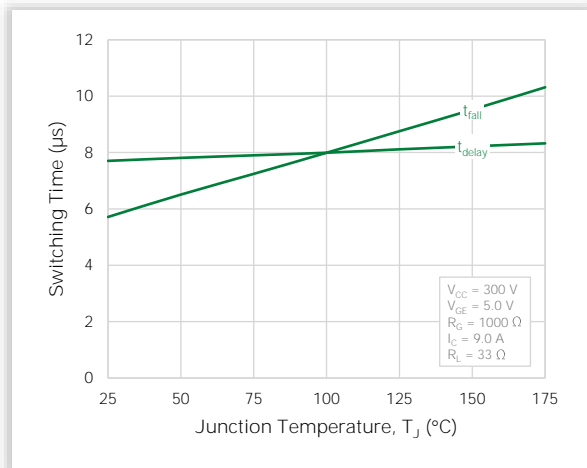


Figure 12. Inductive Switching Fall Time vs. Temperature

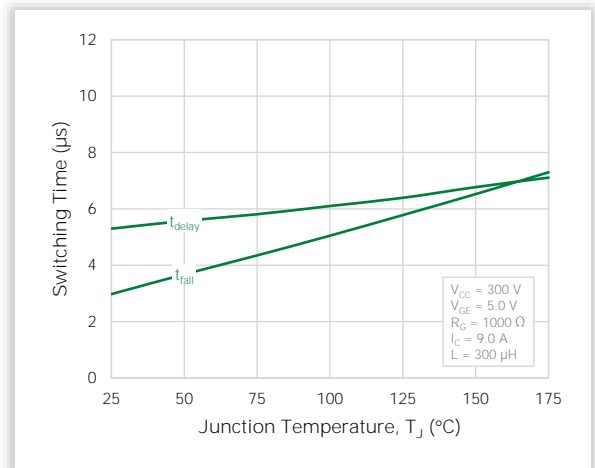


Figure 13. Minimum Pad Transient Thermal Resistance  
(Non-normalized Junction-Ambient)

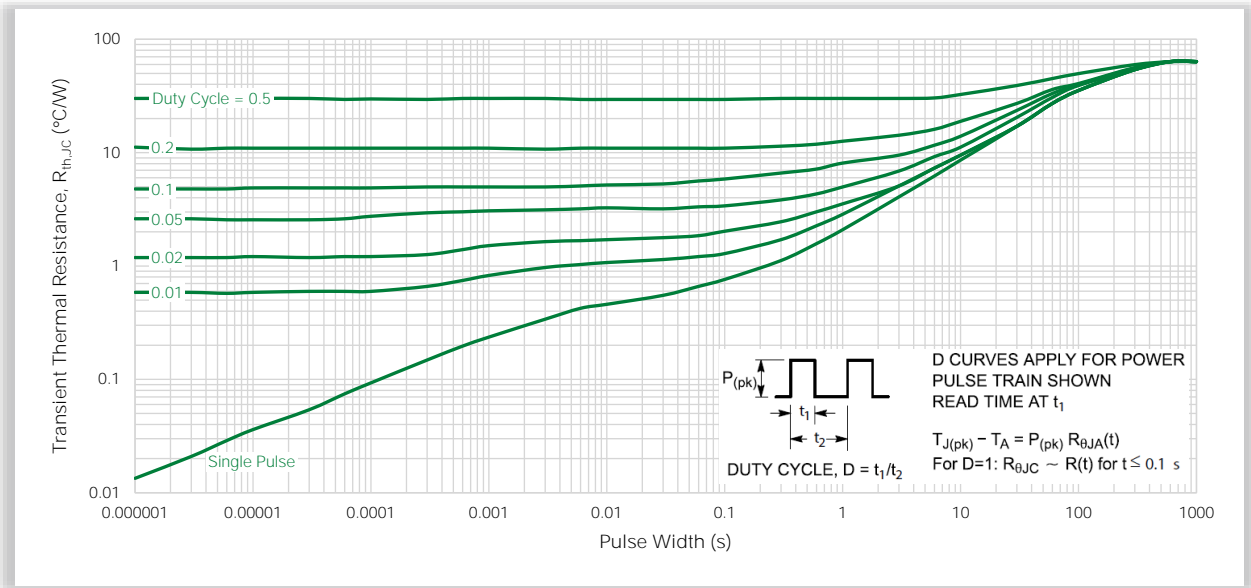
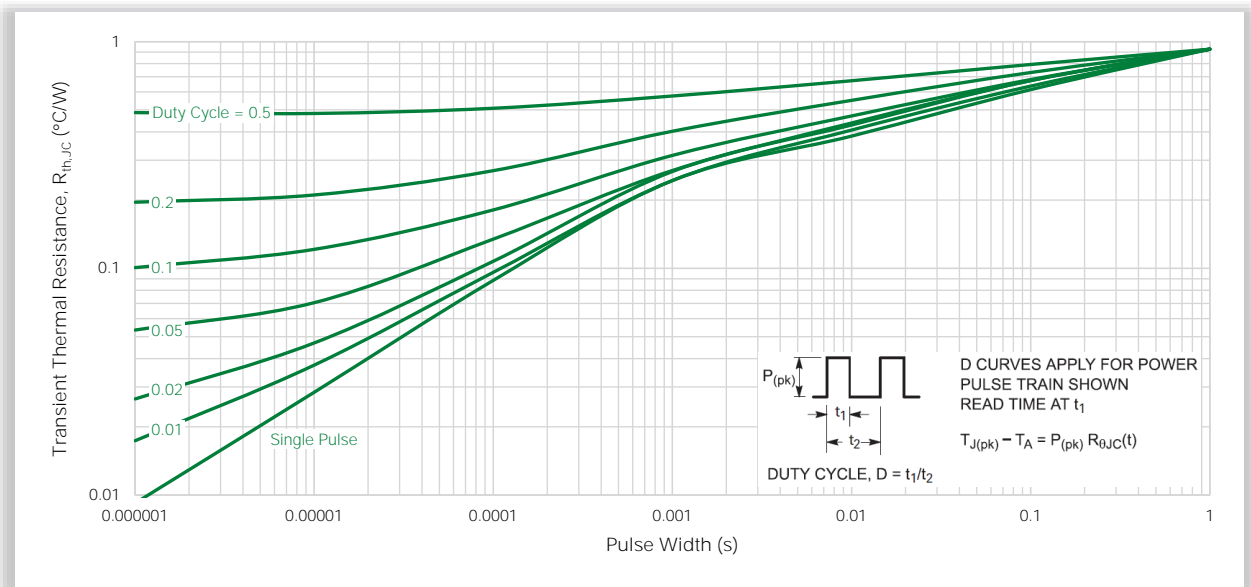
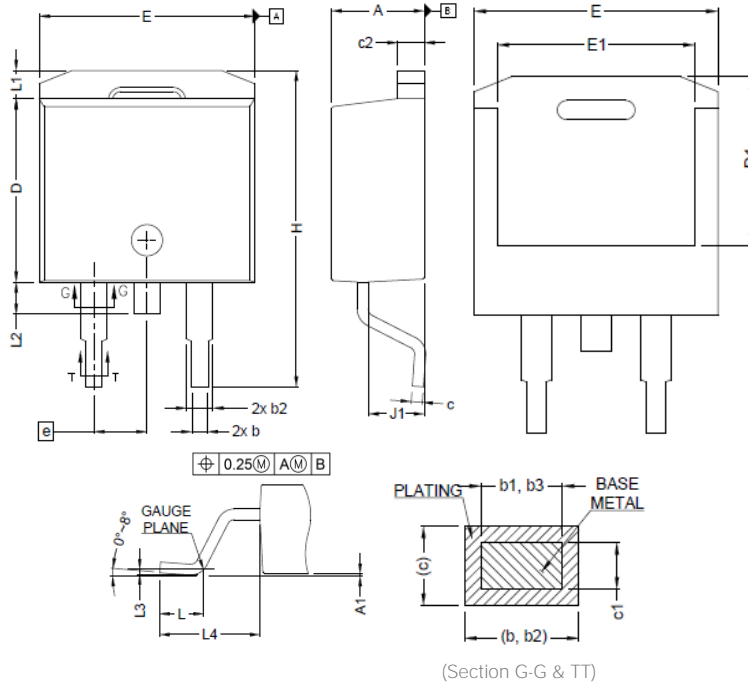


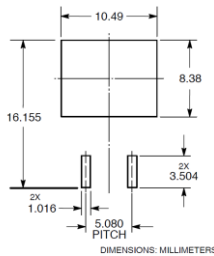
Figure 14. Best Case Transient Thermal Resistance  
(Non-normalized Junction-Case mounted on cold plate)



## 9. Package Dimensions



Recommended Solder Pad Layout:

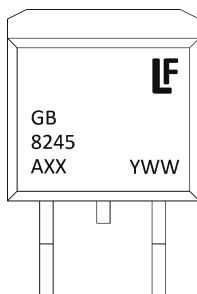


Notes:

1. Dimensioning & tolerancing conform to ASME Y14.5M-1994.
2. All dimensions are in millimeters. Angles are in degrees.
3. Heatsink side flash is max 0.8 mm.
4. Radius on terminal is optional

Symbol	Millimeters		
	Min	Nom	Max
A	4.360	-	4.560
A1	0.000	-	0.250
b	0.700	-	0.900
b1	0.510	-	0.890
b2	1.200	-	1.460
b3	1.170	-	1.370
c	0.380	-	0.694
c1	0.380	-	0.534
c2	1.190	-	1.340
D	8.600	-	9.000
D1	6.900	-	7.500
E	10.150	-	10.550
E1	8.100	-	8.700
e	2.540 BSC		
H	15.000	-	15.600
L	1.900	-	2.500
L1	-	-	1.650
L2	-	-	1.780
L3	0.250		
L4	4.780	-	5.280
J1	2.560	-	2.960

## 10. Part Numbering and Marking



GB8245 = Device Code  
 A = Assembly Location  
 XX = Lot Number  
 Y = Year  
 WW = Work Week

## 11. Packing Options

Part Number	Package	Packing Mode	M.O.Q.
LGB8245TI	D2PAK (Pb-Free)	Tape & Reel	800

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